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FACULTY WORKING
PAPER NO. 1043

Hansen in Retrospect

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May 1984

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Abstract

An early Hansen (1941, 1951) ignored the rate of interest as an equilibrating variable, considered investment autonomous, and assumed the adjustment of saving to a fiscal deficit and autonomous investment to be brought about solely by adjustment of output. Crowding-out was impossible. The key to what happened in fiscal theory after Hansen is the government budget constraint.

Once the rate of interest is admitted as an equilibrating variable it might help accomplishing crowding-out. The extent to which it will, will depend upon the way the fiscal deficit is financed--as expressed by the government budget constraint. An IS-LM diagram is deployed to show the difference between pure bond and pure money financing.

Once the rate of inflation is admitted as an equilibrating variable, an IS-LM diagram becomes inapplicable for two reasons. First, having only a single rate of interest it cannot accommodate the necessary distinction between a nominal and a real rate of interest. Second, being static the IS-LM diagram can accommodate neither the derivative with respect to time implied by a definition of the rate of inflation nor the derivatives with respect to time implied by a nonzero government budget constraint. Paradoxically, however, full dynamization of Hansen (1941) had been accomplished by Samuelson (1939)--three years before Hansen's book was published.

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HANSEN IN RETROSPECT

1. The Government Budget Constraint

The key to what happened in fiscal theory after Hansen is the government budget constraint. Ignoring the government interest bill Hansen (1941, 1949, and 1951) thought of a fiscal deficit merely as the money value of government purchase of goods and services minus government net receipts. On the financing of it he said little but did (1951: 231-236) report Lauderdale's views on debt retirement. Lauderdale (1804) may have been the first to use a government budget constraint but did so implicitly. So did Ohlin (1934). The first to write an algebraic government budget constraint was probably the other Hansen, Bent Hansen (1955: ch. III). Ott and Ott (1965) and Christ (1967) were the first to show that a macroeconomic model becomes dynamic once it incorporates the government budget constraint. As Hansen's had done, their budget constraint failed to include the payment of interest on government bonds. The complete constraint was offered by Blinder and Solow (1974) and Turnovsky (1977). The government budget constraint could then be written as follows.

Define the fiscal deficit as the money value of government purchase of goods and services plus the payment of interest on government bonds minus government net receipts before interest paid by government, or $GP + iQ - R$. Pure money financing of it would mean that the government issued noninterest-bearing claims upon itself called money. Pure bond financing of the deficit would mean that the government issued interest-bearing claims upon itself called bonds and sold them to households and firms. The general case should allow for both money and bond financing, so we write the government budget constraint as

$$GP + iQ - R = \frac{dM}{dt} + \Pi \frac{dQ}{dt} \tag{1}$$

where

$G \equiv$ physical government purchase of goods and services

$i \equiv$ interest payment per annum per govenment bond

$M \equiv$ supply of money

$P \equiv$ price of goods and services

$\Pi \equiv$ price of bonds

$Q \equiv$ physical quantity of government bonds outstanding

$R \equiv$ government net receipts <u>before</u> interest paid by government

$t \equiv$ time

Writing such a government budget constraint had far-reaching consequences that we must now set out.

2. Tying Monetary and Fiscal Policy Together

A government budget constraint was a reminder that in a closed economy, money and bonds could come into existence in no other way than by financing a government budget deficit. *Vice versa* a government budget deficit could be financed in no other way than by expanding the money or bond supplies. Their rates of growth could indeed be considered the policy instruments of monetary and fiscal policy, respectively. Such a choice of policy instruments would remind the reader of the connection between monetary and fiscal policy: did the connection reduce monetary policy to subservience to fiscal policy, then? Not quite. Given the rates of growth of the money and bond supplies, monetary policy might still take corrective action in two forms. By open-market operations in already existing old bonds monetary policy might readjust the money and bond supplies but always in a seesaw

manner, i.e., always expanding one at the expense of the other. Also by varying reserve ratios, monetary policy might make Federal Reserve money go farther or shorter.

3. The Rate of Interest As an Equilibrating Variable: Crowding-Out

In early Hansen (1941, 1951) models the rate of interest was ignored, and physical investment was autonomous, had no give in it, and could not possibly be crowded out. In a system having only one equilibrating variable, i.e., physical output, the adjustment of saving to a fiscal deficit and autonomous investment had to be brought about by adjustment of physical output alone.

Whatever the equilibrating variables are, in equilibrium they will succeed in stopping all leakages. In an open economy, therefore, saving _plus_ import _plus_ government net receipts must become equal to investment _plus_ export _plus_ government purchase of goods and services. A closed economy has neither import nor export. Here, then, saving _plus_ government net receipts must become equal to investment _plus_ government purchase of goods and services or, which is the same thing, saving must become equal to investment _plus_ the fiscal deficit. Consequently in a closed economy investment and saving will be equal only if the government balances its budget. Under a fiscal deficit

investment must fall short of saving, and a higher rate of interest might help accomplishing such crowding-out.

The extent to which it will do so will depend upon the way the budget deficit is financed. To see how, let us once again deploy the Hicksian (1937) IS-LM diagram and consider pure bond and pure money financing in turn.

4. Pure Bond Financing of a Fiscal Deficit

Let government expand its demand G but fail to raise taxes accordingly. Pure bond financing of the resulting government deficit would mean that the government issued interest-bearing claims upon itself called bonds and sold them to households and firms. The money supply would not be affected, and the LM curve would stay put: the economy would still have to economize with the same quantity of money. But the expanded government demand would have pushed the IS curve to the right: at a given rate of interest, the aggregate demand C + I + G would be up.

As IS curve pushed to the right would intersect an unchanged LM curve in a point whose abscissa and ordinate were both higher than before. The upper left-hand case of our figure 3 shows this result. Output is up in order to satisfy the new government demand. The rate

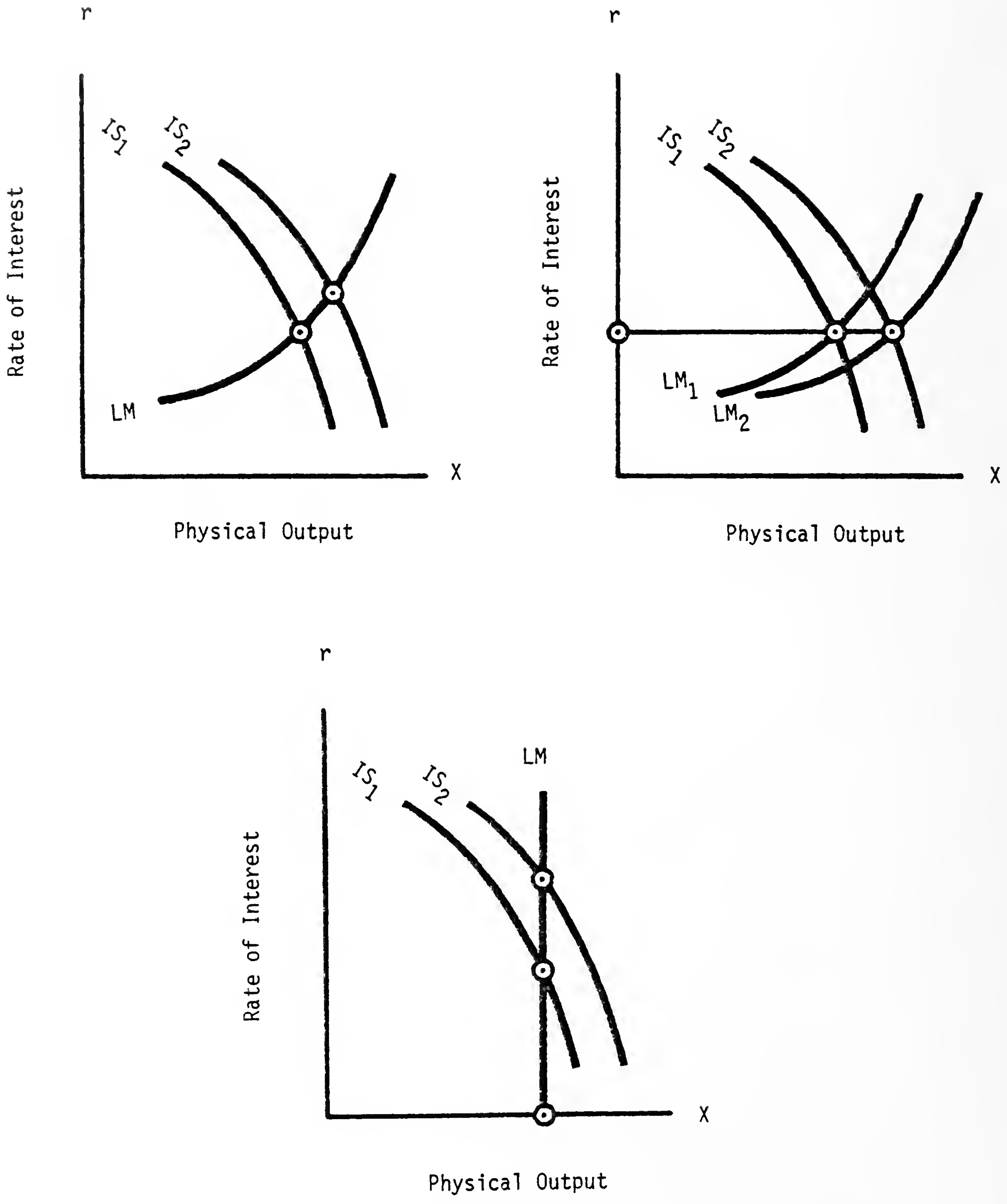

Figure V-3. IS-LM Analysis of Deficit Financing

of interest is up. One effect is to discourage private investment--to some extent government is being satisfied at the expense of private investment. This is crowding-out. Another effect of the higher interest rate is to induce households and firms to hold less cash, so the larger output may be transacted.

5. Pure Money Financing of a Fiscal Deficit

Pure money financing of the government deficit would mean that the government issued noninterest-bearing claims upon itself called money. The money supply would be up and the LM curve pushed to the right. Conceivably the money supply might expand enough to keep the rate of interest from rising at all. In that extreme case there would be no crowding out at all as shown in the upper right-hand case of figure 3.

6. Complete Crowding-Out: An Early Friedman View

The opposite extreme of complete crowding-out might be defined as zero sensitivity of physical output to a bond-financed government deficit. For such zero sensitivity to result, what would the LM curve have to be like? If an IS curve pushed to the right must intersect an LM curve in a point whose abscissa remains the same as before then the

LM curve must stay put and be vertical, as shown in the lower case of figure 3. A vertical LM curve would mean that the demand for money is insensitive to the rate of interest: no rise in the latter would induce households and firms to hold less cash! No rise in the rate of interest would release any money to transact a larger output! Such complete insensitivity of the demand for money to the rate of interest was in fact accepted by an early Friedman (1959) but abandoned by a later one (1966, 1972) and was an extreme and very special case--as extreme and special as the Keynesian opposite assumption of a complete sensitivity of the demand for money to the rate of interest.

7. Intrinsic Nonlinearity

Early Hansen (1941, 1951) models were linear and could be, because they ignored the rate of interest. A government budget constraint called attention to the fact that under bond financing of its deficit the government issued interest-bearing claims upon itself called bonds and sold them to households and firms. The dollar proceeds of a new bond issue would be price of bond _times_ physical quantity of new bonds issued, or $\Pi dQ/dt$. Let the bonds be perpetuities whose market price is a capitalization of their future interest payments. The market price of a bond would then be in inverse proportion to the nominal rate of

interest, would in other words have the nominal rate of interest in its denominator hence make the system nonlinear.

8. A Weakness of the IS-LM Diagram

Including the rate of interest as an equilibrating variable immediately raises the question: which rate of interest, the nominal or the real one? Keynes knew, of course, but did not appreciate Fisher's (1896) distinction between a nominal and a real rate of interest. Keynes (1936: 222-229) did consider "own rates" of interest like a wheat rate of interest, a copper rate of interest, and so on, and discussed their carrying-cost and liquidity aspects. On pp. 142-143 he discussed Fisher's version of such own rates but remained unconvinced. Happily he and Hansen (1941, 1949, 1951, and 1953) begged the question by simply ignoring inflation. In that and only that case the nominal and the real rate of interest will coincide, and one may apply the IS-LM diagram. Had there been inflation one would have encountered the difficulty that the IS curve is a function of the real rate of interest, while the LM curve is a function of the nominal one, and the IS-LM diagram would become inapplicable.

9. The Rate of Inflation As an Equilibrating Variable

One Hansen (1941, 1949, 1951, and 1953) ignored inflation but the other Hansen, Bent Hansen (1955), did not and could not: his work was a Swedish government assignment ordering him to examine how the value of money could be stabilized at full employment. In the United States Keynesians were slow to unfreeze price. In the cores of their fiscal-policy models neither Blinder-Solow (1974) nor Tobin-Buiter (1976) unfroze it, but Turnovsky (1977) did.

The rate of inflation is the growth rate of price and is defined as

$$g_P \equiv \frac{dP}{dt}\frac{1}{P} \tag{2}$$

Once that rate was admitted as an equilibrating variable the IS-LM diagram would have to be abandoned. First, an IS-LM diagram has the single rate of interest r plotted on the vertical axis and physical output X on the horizontal one hence cannot accommodate Fisher's distinction between a nominal and a real rate of interest. Second, an IS-LM diagram is static, hence cannot accommodate derivatives with respect to time such as the definition (2). Still, although analyzing

inflation, Friedman (1970) tried to do so within the framework of the IS-LM diagram.

10. Intrinsic Dynamics: Short-Run and Long-Run

Paradoxically full dynamization of Hansen (1941) had been accomplished by Samuelson (1939) three years before the book was published. Intuitively Hansen saw, first, physical investment as the change in desired physical capital stock or $I(t) \equiv S(t) - S(t - 1)$. Second, Hansen saw desired physical capital stock in direct proportion to physical output of consumers' goods or $S(t) = bC(t)$, where the factor of proportionality b was the accelerator. Hansen could then work out the arithmetic of an interaction between the multiplier and the accelerator. Bewildered by the multitude of possibilities thus opening up he turned to his brightest student for help. Ignoring taxes Samuelson (1939) wrote out Hansen's system as the lagged consumption function

$$C(t) = cX(t - 1), \tag{3}$$

the lagged investment function

$$I(t) = b[C(t) - C(t - 1)], \tag{4}$$

and the goods-market equilibrium condition

$$X(t) = C(t) + I(t) + G(t) \tag{5}$$

where, in our own notation:

$b \equiv$ the accelerator

$C \equiv$ physical consumption

$c \equiv$ propensity to consume

$G \equiv$ physical government purchase of goods and services

$I \equiv$ physical investment

$S \equiv$ physical capital stock

$t \equiv$ time

$X \equiv$ physical output

Solving his system Samuelson found the second-order linear difference equation in physical output:

$$X(t) = (1 + b)cX(t - 1) - bcX(t - 2) + G(t) \tag{6}$$

where $G(t)$ was a constant. The characteristic equation corresponding to (6) would be a quadratic. If its roots were complex, physical output

would display oscillations but otherwise either converge to the multiplier $1/(1 - c)$ _times_ the constant level of government purchase $G(t)$ or be growing smoothly.

Any model including lags or derivatives with respect to time is dynamic. Our definition (2) included such a derivative. But a full fiscal-policy model will have more of them. Because it includes derivatives with respect to time, a nonzero government budget constraint will remind the reader of what Turnovsky (1977) called its "intrinsic dynamics": solutions will be time paths rather than equilibrium levels.

While dynamic, a full fiscal-policy model could remain short-run in the sense that an attempt would be made neither to trace the effect of investment upon physical capital stock, to use a production function relating the flow of physical output to physical capital stock, nor to optimize the latter. Blinder-Solow (1974) still made no such attempts, but Turnovsky (1978, 1980) did and for good reasons.

Crowding-out raises two questions neither of which can be satisfactorily dealt with by short-run dynamics. First, crowding-out must work _via_ some mechanism describing what desired investment is a function of. Desired investment must be the investment that will bring actual physical capital stock into accordance with the desired one. So a full fiscal-policy model must come to grips with the optimization of physical capital stock hence use long-run dynamics.

Second, once the crowding-out mechanism has been set out the consequences for the rest of the economy must be found. Will the capital coefficient be affected, and is the capital coefficient of any consequence for the real wage rate? Such questions can be answered only within the framework of growth theory, i.e., long-run dynamics, and we are doing so in Faculty Working Paper #979, "Rational Expectations and Policy Neutrality in a Friedman Inflation Equilibrium".

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